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Implementation of IoT Based Smart Patient Health Monitoring System using Arduino

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Abstract- The goal of this project is to help the people to get the proper treatment and diagnosis with all the advanced medical technologies in time. The IoT (internet of things) have been extensively used to connect the advanced clinical assets and offer smart, reliable, and fine healthcare services to patients. It has been implemented by using different type of sensors to monitor the vital signs in patients heartbeat conditions, temperature and humidity. Transmission of the information from the body sensors to the server is done by the WI-FI module where the data is stored in server. The Arduino microcontroller is used to convert the data into readable signals. The doctor can view the patient's condition through laptop or through the android phones from the cloud servers. The main purpose of this paper is both patient and doctor can have the real time communication and is extremely helpful for chronically ill, elderly and even for bedridden patients in home.

Key Words: Arduino UNO, WIFI imodule, Internet of Things (IOT).

1.INTRODUCTION

A remote health monitoring wearable device ensures safe and sound life as they are extremely usefull and reliable. In this paper we are monitoring only three vital signs in the patient's body such as heartbeat, temperature and humidity the remote monitoring of these conditions will have a great significance in the medical field. The main objective of the project was to design a remote healthcare system. It's comprised of three main parts. The first part being, detection of patient's vitals using sensors, second for sending data to cloud storage and the last part was providing the detected data for remote viewing. Remote viewing of the data enables a doctor or guardian to monitor a patient's health progress away from hospital premise. The proposed architecture collects the sensor data through Arduino microcontroller and relays it to the cloud where it is processed and analyzed for remote viewing. Feedback actions based on the analyzed data can be sent back to the doctor or guardian through Email and/or SMS alerts in case of any emergencies.

A. AIM

Main aim of this project is to make a simple, easily controllable and cheap device which helps to make patient's life easier. This project is to design and construct an intelligent wearable device that records and manages many health aspects such as heartbeat, temperature and humidity.

2. SYSTEM DESIGN

Detailed design starts after the system design phase is completed and the system design has been certified through the review. The goal of this phase is to develop the internal logic of each of the modules identified during system design.

A. Data Flow Diagram

DFD graphically representing the functions, or processes, which capture, manipulate, store, and distribute data between a system and its environment and between components of a system. The visual representation makes it a good communication tool between User and System designer. Structure of DFD allows starting from a broad overview and expand it to a hierarchy of detailed diagrams.

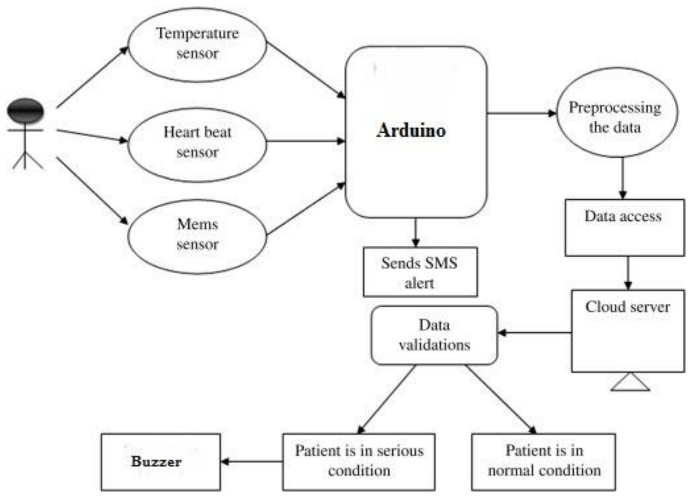

Fig -1: Data Flow diagram

B. Use case diagram

Use case diagram is a graph of actors, a set of use cases enclosed by a system boundary, communication associations between the actor and the use case. The use case diagram describes how a system interacts with outside actors; each use case represents a piece of functionality that a system provides to its users. A use case is known as an ellipse containing the name of the use case and an actor is shown as a stick figure with the name of the actor below the figure.

The use cases are used during the analysis phase of a project to identify and partition system functionality. They separate the system into actors and use case. Actors represent roles thatare played by user of the system. Those users can be humans, other computers, pieces of hardware, or even other software systems.

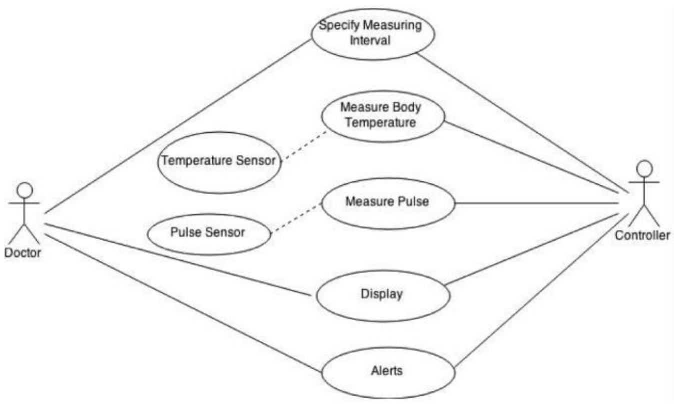

Fig -2: Use Case Diagram

A. Sequence Diagram

A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are sometimes called event diagrams, event scenarios.

UML sequence diagrams are used to represent or model the flow of messages, events and actions between the objects orcomponents of a system. Time is represented in the vertical direction showing the sequence of interactions of the header elements, which are displayed horizontally at the top of the diagram Sequence Diagrams are used primarily to design, document and validate the architecture, interfaces and logic of the system by describing the sequence of actions that need to be performed to complete a task or scenario. UML sequence diagrams are useful design tools because they provide a dynamic view of the system behavior.

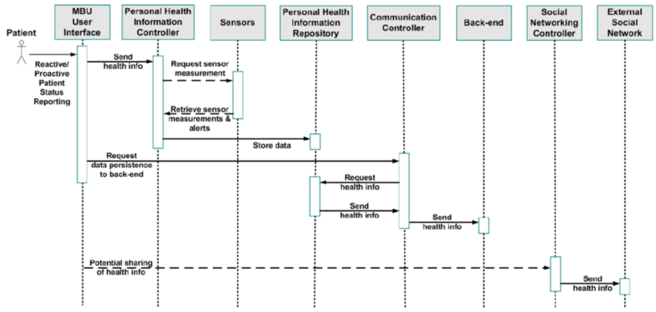

Fig -3: Sequence Diagram

D. Activity Diagrams

Activity diagrams represent the business and operational workflows of a system. An Activity diagram is a dynamic diagram that shows the activity and the event that causes the object to be in the particular state. It is simple and intuitive illustration of what happens in a workflow, what activities can be done in parallel, and whether there are alternative paths through workflow.

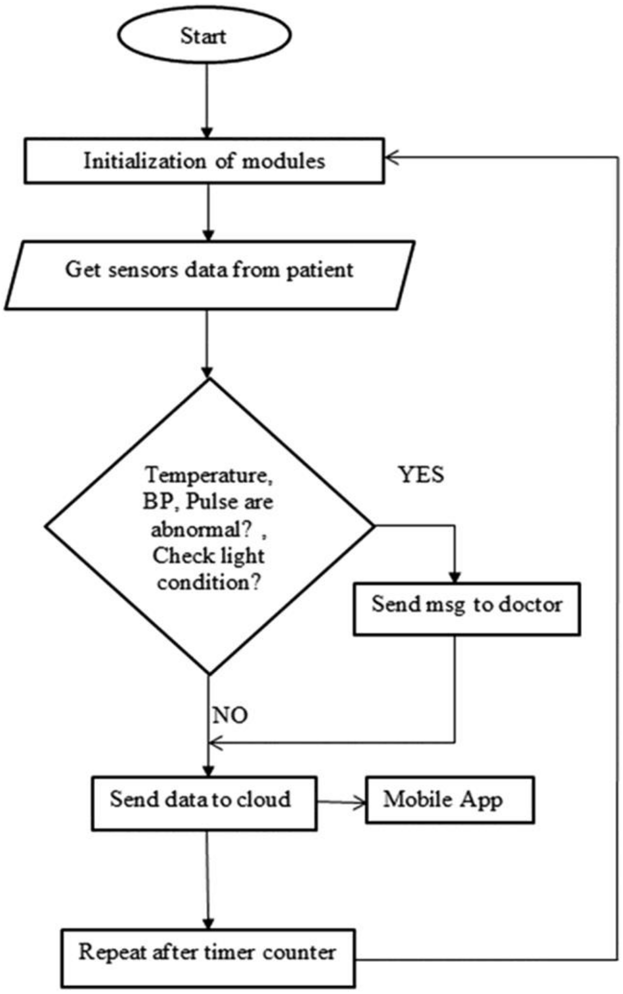

Fig -4: Activity Diagram.

3. IMPLEMENTATION

Following are the Algorithms used for this project:

1. Parallel Conversion type of Implementation:

In this type of implementation both the current system and the proposed system run in parallel. This happens till the user gets the complete confidence on the proposed system and hence cuts of the current system.

2. Phase-in method of implementation:

In this type of implementation the proposed system is introduced phase-by-phase. This reduces the risk of uncertainty of proposed system. Each program is tested individually at the time of development using the data and has verified that this program linked together in the way specified in the programs specification, the computer system and its environment is tested to the satisfaction of the user. The system that has been developed is accepted and proved to be satisfactory for the user. And so the system is going to be implemented very soon. A simple operating procedure is included so that the user can understand the different functions clearly and quickly.

The project is implemented in modular approach. Each module is coded as per the requirements and tested and this process is iterated till the all the modules have been thoroughly implemented.

Fig -5: Block Diagram of Smart Aquarium System

In our system Arduino microcontroller UNO is centralize unit of system. It is three port device each port having 8 input and output pins. It is interface with all other devices in our system such as,

a) Heartbeat sensor- it is use to measure the heartbeat and pulse rate of the patient

b) Temperature sensor -it is a water proof temperature sensor and will use to sense the temperature of the patient.

c) Humidity sensor- will measure the humidity level of the patient.

d) Battery -We will use in absence of main power supply. Water level sensor- is use to control water level while changing the water of aquarium.

e) Display- it will show the real time conditions of the patient. Buzzer- alerts during an anomaly in patient's health

f) WiFi module- will upload the patient's data to the cloud

4. SCREENSHOTS

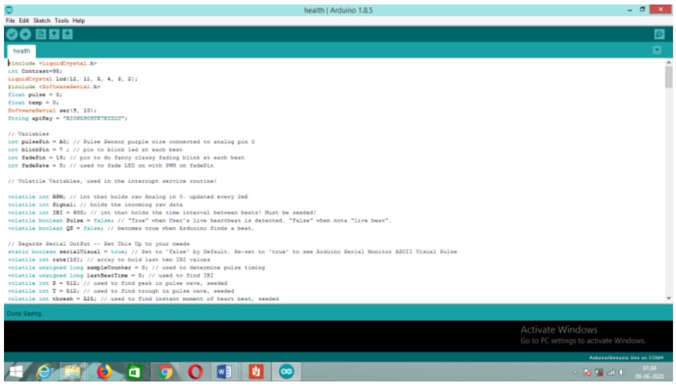

Fig -6: Coding

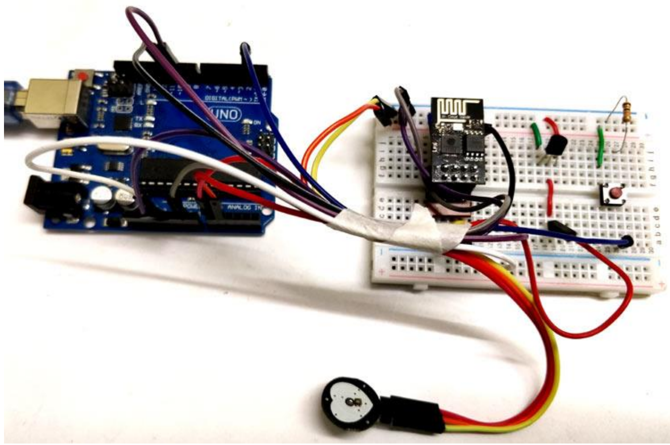

Fig -7: Design

Fig -8: Output from clou

5. CONCLUSIONS

The main objective of the experiment was successfully achieved. All the individual modules like Heartbeat detection module, fall detection module etc. and remote viewing module gave out the intended results. The designed system modules can further be optimized and produced to a final single circuit. More important fact that came up during project design is that all the circuit components used in the remote health detection system are available easily. With the development in the integrated circuit industry, Micro Electro Mechanical Systems (MEMs) and microcontrollers have become affordable, have increased processing speeds, miniaturized and power efficient. This has led to increased development of embedded systems that the healthcare specialists are adopting. These embedded systems have also been adopted in the Smartphone technology. And with increased internet penetration in most developing countries through mobile phones, and with use of Internet of things (IoT) will become adopted at a faster rate. The Remote Health Care system utilizes these concepts to come up with a system for better quality of life for people in society. From an engineering perspective, the project has seen concepts acquired through the computer science and embedded study period being practically applied.

The Electric circuit analysis knowledge was used during design and fabrication of the individual modules. Electromagnetic fields analysis used in the wireless transmission between microcontrollers and Software programming used during programming of the microcontrollers to come up with a final finished circuit system.

6. FUTURE SCOPE

a) Physiological data collection 1. Home Ultrasound 2. Brain signal monitoring b) Remote viewing of data 1. Problems associated with having data online. Tackle Distributed denial of service. DDOS, and Data privacy/security especially of medical systems. c) IoT based Remote Patient Monitoring System can be enhanced to detect and collect data of several anomalies for monitoring purpose such as home ultrasound, Brain signal monitoring, Tumor detection etc. d) More research on problems associated with having data online, data privacy as IoT is managed and run by multiple technologies and multiple vendors are involved in it. Security algorithms and certain precautions by the users will help avoid any security related threats in IoT network. e) The interface can be designed to control which sensors can be used by consumers according to their needs. f) Web UI can be enhanced to perform several activities which include controlling the hardware, real-time graphs, history and analysis graphs to observe anomalies etc.

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